— CHAPTER 4 —

Rules for the governance of coastal and marine ecosystem services:

An evaluative framework based on the IAD framework[c]

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CHAPTER 4

Abstract

There is an increasing need for a comprehensive institutional understanding pertaining to ecosystem services (ESs) in coastal and marine fields. This chapter develops a systematic framework to inform coastal and marine governance about the integration of ES thinking. First, as a theoretical basis, we analyze the generic rules that are part of the Institutional Analysis and Development (IAD) framework. Second, by an extensive literature review, we formulate a set of ES-specific rules and develop an evaluative framework for coastal and marine governance. Third, we examine this evaluative framework in a specific action situation, namely coastal strategic planning concerning Qingdao, China. Results from the literature review and the case study reveal that when designing ES-specific rules for coastal and marine governance, there are several socio-spatial and economic aspects that should be taken into account: (1) conceive of stakeholders as ES users, (2) capture the effect of ecological scaling, (3) understand ES interactions and clarify indirect impacts and causalities, (4) account for ES values, and (5) draw on economic choices for use rights to deal with ES issues.

Key words:

Rules; Institutional analysis; Evaluative framework; Ecosystem services; Coastal and marine governance

4.1 Introduction

Ecosystem services (ESs) are generally defined as the benefits people obtain from ecosystems (MA, 2005), along with variations of classification schemes and definitions for characterizing different ESs (e.g., Costanza et al., 1997; De Groot et al., 2010). Many associated approaches have been developed for evaluating ES values (Börger et al., 2014), modeling/mapping ecological stocks and flows (Maes et al., 2012), identifying ES interactions (Raudsepp-Hearne et al., 2010), and creating incentives of payments for ESs (Lau, 2013; Vatn, 2010). These concepts with the classifications and approaches help to explain human-nature relationships and to widely support policies for identifying, predicting, negotiating, and managing policy consequences, which substantially contribute to sustainable development (Ingram et al., 2012).

To better integrate ESs in decision making, scholars have emphasized the role and importance of institutions. Adopting an institutional perspective for the analysis of ESs is helpful in understanding the structures behind the complex processes of coordination and cooperation in coastal and marine governance. For coastal and marine areas these processes typically include "bundles" of ESs (e.g., fisheries, algae energy, and tide power), resulting in trade-offs and synergies among stakeholders (Bennett et al., 2009; Raudsepp-Hearne et al., 2010). They also feature uncertainties regarding climate change and coastal degradation, resulting in a need for adaptive policy making and knowledge (Turner, 2000). Moreover, many coastal and marine ES issues are of a large scale, usually involving actors at multiple governance levels. A focus on the institutions that coordinate human actions and interactions helps to identify governance solutions based on the ES concept (Carpenter et al., 2009).

In this context, it has often been argued that the integration of ESs into coastal and marine governance requires "the development of institutional arrangements that are flexible and responsive to local contexts and that are applicable at a variety of scales of management" (Raymond et al., 2013, p.544). Consequently, there has been an increasing interest in analyzing institutions for managing coastal ESs, often with a singular focus, such as fisheries, coral reefs, and wetlands (Bruckmeier & Höj Larsen, 2008; Namaalwa et al., 2013; Nursey-Bray & Rist, 2009). These case studies demonstrate institutional innovations (e.g., co-management), providing experience towards fitting institutions to ecosystems. The second focus of the institutional analyses is on ES instruments aimed at improving the application of the instruments in practice (Börger et al., 2014; Lau, 2013). Finally, rather than focusing on a single issue, species, or instrument, scholars have studied institutional settings for spatial strategies used for ES governance, such as ecosystem-based management (EBM), marine spatial planning (MSP), marine protected areas (MPAs), and ocean zoning, to understand the full range of relationships among human activities and ESs (Carollo & Reed, 2010; Francour et al., 2001; Pomeroy & Douvere, 2008; Sanchirico et al., 2010).

To summarize, previous research suggests that coastal and marine governance is difficult because of ES dynamic interactions, various uncertainties, and cross-boundary issues. Scholars have struggled to determine what kind of institutional innovations may be needed, thereby either focusing on a single issue, species, or ES approach or on institutional arrangements for a certain spatial strategy. As a result, a more comprehensive institutional understanding pertaining to ESs in coastal and marine fields is still missing.

The main purpose of this chapter is to develop an evaluative framework for coastal and marine governance to systematically understand how institutions could facilitate the integration of ESs. Rules are a key factor to structure policy situations of human action (Crawford & Ostrom, 1995). Rules provide guidance for addressing complex issues, such as access to different ESs at the same location, and benefit-sharing and cost-bearing mechanisms across boundaries. We take the Institutional Analysis and Development (IAD) framework developed by Ostrom (2011) as our theoretical starting point, as the IAD framework provides a comprehensive list of generic rules that structure policy actions under a broad and dynamic social-ecological context. We then report on an extensive literature review of previous research about coastal and marine governance of ESs. On the basis of this literature review, we formulate a set of ES-specific rules and develop an evaluative framework for coastal and marine governance. Subsequently, we apply the framework to the action situation of coastal strategic planning for Qingdao, a large city in China. We conclude this chapter by discussing several key socio-spatial and economic aspects that should be considered when designing ES-specific rules for coastal and marine governance.

4.2 The IAD framework and the concept of rules

The IAD framework proposed by Ostrom (2011) distinguishes itself by, among other things, "a systematic, theoretical focus on the impact of rules and norms on individual incentives in complex ecological-economic systems" (Rudd, 2004, p.110). The IAD framework provides a way to understand a broad context of actions and interactions. Compared to other institutional analysis approaches, an important strength of the IAD framework is structurally detailing the action situation relevant to policy actors, following a systematic set of rules (Ostrom, 2011). The framework attempts to include all of the possible rules that are typical for policies. The classification of the rules is according to the impact of the rules on different elements (e.g., actors, actions, and information) of an action situation (Figure 4.1).

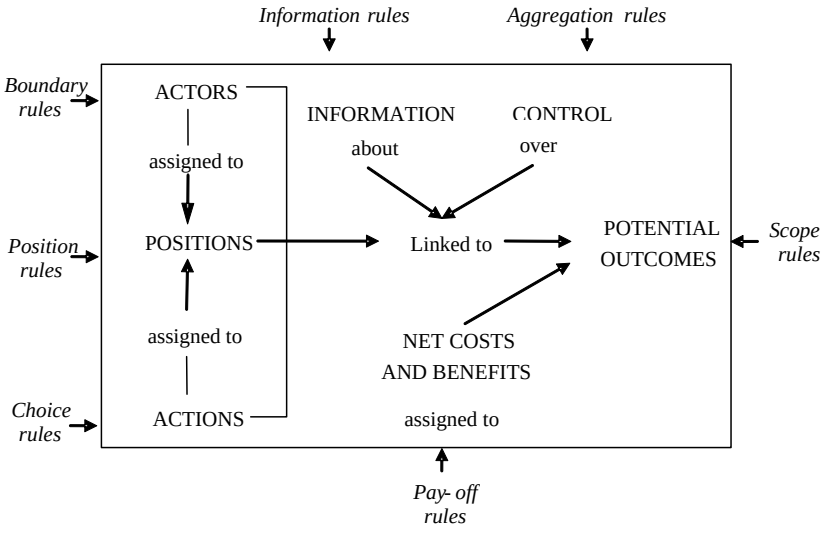

Figure 4.1 Rules affecting the elements of an action situation (Ostrom, 2011)

According to Ostrom (2011), rules are "shared understandings among those involved that refer to enforced prescriptions about what actions (or states of the world) are required, prohibited, or permitted" (p.17). The IAD framework highlights rules-in-use, which are the rules that are promulgated or otherwise established through the actual implementation of governance in action situations (McGinnis & Ostrom, 2012; Ménard, 2014). In that respect, rules-in-use directly affect the choices, behaviors, and attitudes of the actors and assist with the construction of an action situation. Therefore, these rules are essential to an institutional analysis. In our case, rules-in-use are important to comprehend the integration of ESs into coastal and marine governance.

There are seven types of rules that can be distinguished and that can influence the elements of an action situation (Figure 4.1). *Position rules* establish a set of positions or roles, which are held by different types of participants in an action situation (McGinnis, 2011; Ostrom, 2011). *Boundary rules* specify how the actors are chosen to enter or leave these positions, thus influencing the number, attributes, and resources of the participants (Ostrom, 2010). *Choice rules* specify what actions assigned to an actor in a position are allowed, obliged, and prohibited. In this way, these rules directly determine responsibilities, rights, and freedom. *Aggregation rules* "determine how decisions are made in an action situation" (Polski & Ostrom, 1999, p. 16-17). This type of rule specifies who will be involved in the choice and how much each actor's decision could contribute to "the transformation function from actions to intermediate or final outcomes" (McGinnis, 2011, p.174). *Scope rules* specify "the potential outcomes that can be affected and, working backward, the actions linked to specific outcomes" (Ostrom, 2011, p. 20).

Thus, these rules delimit the factors (e.g., an actor's understanding of authorized geographic domains) that may lead to specific outcomes of an action situation. *Information rules* specify what information is available to each position; these rules affect the channels of communication among the participants (Ostrom, 2010). Finally, *payoff rules* "affect the benefits and costs that will be assigned to particular combinations of actions and outcomes, and they establish the incentives and deterrents for action" (Ostrom, 2011, p. 20).

4.3 ES-specific rules: an evaluative framework for coastal and marine governance

Based on the list of rules developed by Ostrom (1999), an extensive literature review was conducted to gain a systematic overview of the specific rules required for integrating ES concepts into coastal and marine governance. For this purpose, we identified all of the journal publications dealing with coastal and marine governance of ESs in the electronic databases of Science Direct and Web of Science. We used the following key words in the title: "ecosystem services," "ecosystem," "coastal," "marine," "coast," and "ocean." We then refined the results by searching for topics related to "institution," "management," "planning," and "governance." We finally read abstracts and selected the papers that focused on applying and assessing ES-related concepts, frameworks, and approaches under the existing context of at least one coastal and marine social-ecological systems. The social-ecological systems ranged from one certain ecosystem (e.g., a fishery and a coral reef) to multiple ecosystems within a large-scale area (e.g., MSP areas and integrated coastal zones). The policy processes varied from local, regional, national, and international scales. Finally, we ended with a database of 97 peer-reviewed articles published from 2000 to 2014. Table 4.1 provides the results from combining the general definitions of the rules in the IAD framework with the articles on coastal and marine governance.

Table 4.1 ES-specific rules-in-use for coastal and marine governance

Rules	Relevance for ESs	Reference Examples
Position	Governments act as "regulators of competition" rather than "promoters of development." Scientific groups act as supporters of ES knowledge. Non-governmental stakeholders are included mainly as ES users to maintain the sustainable provision of ESs.	Evans & Klinger, 2008; Freestone et al., 2014; Maltby et al., 2013; Mow et al., 2007; Pittock et al., 2012
Boundary	Selection criteria consider the actors' responsibilities and ecological and social knowledge, as well as the potentially affected users. Stakeholders are involved early and throughout the entire decision-making process.	Biggs et al., 2012; Börger et al., 2014; Halpern et al., 2012; Holt et al., 2011; Katsanevakis et al., 2011
Choice	ES use activities are specified through choice limitations per coastal and marine zone. Use-and-entry choices of ESs are specified by focusing on use rights.	Day, 2002; Filatova, 2014; Katsanevakis et al., 2011; Sanchirico et al., 2010
Aggregation	Rules stimulate a mix of top-down and bottom-up decisions to capture local-level ES priorities and address higher-level conflicts. Authority is allocated based on the characteristics of an ecosystem and collective decision making.	Bruckmeier & Höj Larsen, 2008; Evans & Klinger, 2008; Valman, 2013
Scope	Institutions match with ecological scales to determine ES allocation and efficient environmental outcomes. Interactions among ESs and interrelationships among relevant users are specified.	Bennett et al., 2009; Ekstrom & Young, 2009; Hanna, 2008; Raudsepp-Hearne et al., 2010
Information	Information about ES conditions is incorporated in decision-making processes. Ecosystem demands and social-cultural values are clarified. Information is available on how people use and impact ESs, particularly regarding cumulative and indirect impacts. Information on where ESs occur is specified in spatial terms to make the decision-making process transparent.	Bryan et al., 2010; Halpern et al., 2008; Lopes & Videira, 2013; Potts et al., 2014;
Payoff	Benefits and losses are understood from an economic-oriented perspective, which considers impacts and causalities.	Bruckmeier & Höj Larsen, 2008; Busch et al., 2011; Kay et al., 2003

Position Rules

The position rules focus on which actors should be involved in the action situation and on establishing the positions or roles of the actors. Previous studies suggest that the governance of coastal and marine ESs should include relevant governments (and their agencies), scientific groups, and a range of non-governmental stakeholders (e.g., private institutions, coastal citizens, and non-governmental organizations [NGOs]). With respect to the positions of these three groups of actors, it is argued that the governments should be able to play the role of "regulators of competition" rather than "promoters of development" (Pittock et al., 2012). The traditional command-and-control position of governments is not flexible and effective enough to address the complexities concerning ESs. Therefore, the literature suggests that the governments should transfer their position to coordinating and facilitating social incentives through regulatory support. For instance, the governments could ensure strategic alliances of multi-layered objectives and create clear accountability to stimulate co-management and tradable markets for ESs (Maltby et al., 2013; Mansfield, 2006; Nielsen et al., 2004). To help the governments better perform this new role, scientific groups are generally seen in a collaborative role with the governments involved. Throughout the years, experts, advisory bodies, and technical agencies have actively participated as planning consultants, technical supporters, or ES knowledge accommodators; consequently, they strongly contribute to defining the monitoring scope of the ecosystems, assessing impacts, evaluating plans, and providing tools (Evans & Klinger, 2008; Maynard et al., 2011; Namaalwa et al., 2013).

Finally, the previous studies on coastal and marine governance also emphasize, in particular, the role of non-governmental stakeholders as active actors for managing ESs. The literature points out, for instance, that marine industrial manufacturers, fishermen, and tourists often perform the role of ES users; whereas at the same time, they should also take the responsibility for guaranteeing a sustainable provision of ESs. Due to the multiple demands of interlinked ESs and associated conflicts among the ES users, it is necessary to coordinate the contribution of different interest groups (Mow et al., 2007). NGOs, in particular, usually become a successful cooperator to deal with the conflicts by promoting initiatives for new forms of ES governance, such as regional agreement making for sea use and regional committee building for securing marine protection measures (Freestone et al., 2014). It is also argued that non-governmental stakeholders should be active in bringing in diverse perspectives, preferences, feedback, and local knowledge, thereby contributing to the development of plans as evaluators (Hauck et al., 2013; Mow et al., 2007).

Boundary Rules

Boundary rules determine what criteria should be used to select participants and determine when the participants should enter or leave their positions. Previous studies first emphasize that

selection criteria should consider the responsibilities about who is involved in coastal and marine governance, on-the-ground ecological and social knowledge, and the intended audience for governance processes and results (Holt et al., 2011; Seppelt et al., 2012). Among these criteria, more attention has been paid to potentially affected actors, hereby expanding the scope of participation that used to focus only on direct users (Halpern et al., 2012; Haines-Young & Potschin, 2014). One reason for this trend is that people tend to realize the importance of the long-term benefits for well-being (e.g., habitat maintenance and climate regulation). Another reason is that the dynamic interactions among ESs often cause off-site effects on the stakeholders at different scales. Another lesson from previous research is that boundary rules should enable the stakeholders to be involved early and throughout the entire decision-making process, rather than only being consulted at the final stage (Börger et al., 2014; Hanna, 2008; Katsanevakis et al., 2011). Their engagement would facilitate solutions for conflicting goals, monitoring and accounting for ES flows, and detecting anthropogenic disturbances on the ecosystems (Biggs et al., 2012; Hauck et al., 2013; Mow et al., 2007; Pittock et al., 2012).

Choice Rules

The choice rules focus on allowing, obliging, and prohibiting specific actions regarding coastal and marine uses (i.e., what actions participants may, may not, and/or must take in governing ESs). The choice rules should specify certain actions by setting different choice limitations per coastal and marine zone. Specifically, the ecological conditions, use functions, and conservation objectives of each zone determine what activities are allowed (e.g., a nature reserve) or are prohibited (e.g., discharging pollution and reclamation) for each area (Day, 2002). Such rules are helpful to avoid exclusiveness for certain ESs and to encourage multi-utilization (Katsanevakis et al., 2011; Sanchirico et al., 2010). Meanwhile, to better manage ES uses, previous research also presents that the choice rules should focus on use rights as a way to specify use-and-entry choices per zone. Examples are permits and economic-oriented choices per zone for use rights (Beaudoin & Pendleton, 2012; Katsanevakis et al., 2011). The choices for use rights are gradually required for linking with economic mechanisms (e.g., allowing a tradable market to sell and buy coastal developing rights for using vulnerable ESs) (Filatova, 2014).

Aggregation Rules

The aggregation rules specify how decisions are being made in the governance of coastal and marine ESs. The literature review shows that these rules should stimulate a mix of top-down and bottom-up decisions to capture local-level ES priorities and address higher-level conflicts (Evans & Klinger, 2008; Goldman-Benner et al., 2012). Typically, in most coastal and marine cases, the governments are decisive in the final approval of policies, plans, strategies, and

projects relevant for ESs. However, there is an increasing empowerment of the "weak" groups. Currently, the governments are more willing to provide decisive room (e.g., arrange fishery co-management and MPAs establishment) for local resource users and conservation interest groups as a way to enhance ES preservation and responses to higher-level plans (Bruckmeier & Höj Larsen, 2008; Kalikoski et al., 2002; Olsson et al., 2004a). Meanwhile, a certain degree of centralized decision making is still necessary to provide strategic views and comprehensive methods for local initiatives. In addition, to face cross-border and large-scale ES issues, the aggregation rules should allocate the authorities following the characteristics of an ecosystem (e.g., its scale). ES concept holds "the possibility of new collaborative decision making" (Pittock et al., 2012, p.118), such as the catchment management bodies in Australia (Maynard et al., 2011) and the Baltic Marine Environment Protection Commission (Valman, 2013).

Scope Rules

The scope rules pertaining to ESs determine the understandings that affect the outcomes of ES governance. Previous studies show that the scope rules should take ecological scale into consideration (Day, 2002; Holt et al., 2011). Such geographical focus could determine how to allocate ESs and how to produce efficient and sustainable outcomes. For instance, there are rules of spatial partitions for development, such as marine wind energy, tourism, and habitat preservation, based on ecological features and scales (Katsanevakis et al., 2011). Setting institutions, such as legislations, should match the characteristics of the ecosystem that these institutions apply to as much as possible (Ekstrom & Young, 2009); otherwise, their mismatches could result in high transaction costs and less efficient outcomes (Hanna, 2008). Besides, ES interactions (i.e., trade-offs and synergies) and related user interrelationships should be clarified as part of the scope of the decision-making process. Then, the range of decision outcomes would be limited to particular ecological areas and to groups of affected people. This clarification is critical to reduce conflicting policy objectives and use competitions (Bennett et al., 2009; Raudsepp-Hearne et al., 2010). Managing interactions could be done by identifying the conflicting objectives and transforming a single-species focus to a multiple-service focus (Evans & Klinger, 2008; Wilkinson et al., 2013).

Information Rules

The information rules specify which ES-related information is available and necessary for stakeholders. Previous studies about coastal and marine governance indicate that the information rules should serve to clarify information on the following four aspects. First, information about ES conditions (e.g., ES flows, functions, baselines, thresholds, benefits, and connections) should be incorporated in the decision-making processes and policy measures (Pittock et al., 2012; Potts et al., 2014). Obtaining information about ES conditions may cause beneficial changes in the actors' behaviors and the policy priorities (Salzman et al., 2001).

Second, the information rules should clarify what people want from the ecosystems, focusing on the diversity of the demands and the social-cultural values attached to the services (Lopes & Videira, 2013; Maes et al., 2012). Such information is helpful to integrate multiple goals, conduct cost-benefit analyses, and create dialogue about how ESs can be incorporated within management practices (Laurans & Mermet, 2014; Matzdorf & Meyer, 2014). Third, the impacts of coastal and marine activities on ESs, especially their cumulative and indirect effects, are another primary input that the stakeholders need (Evans & Klinger, 2008; Halpern et al., 2008). Such understanding could benefit the formulation of a long-term goal and solutions for conflicts. Fourth, the previous studies emphasize spatial and visual information, which is important to improving decision-making transparency and to better allocating ESs. Spatial information and visual information, in particular, could illustrate where activities, impacts, risks, conflicts, and connections could occur simultaneously (Bryan et al., 2010; Maes et al., 2012).

Payoff Rules

Finally, the payoff rules for ES governance affect the benefits and the costs caused by the conflicts involving indirect impacts and causalities. Previous research shows that the payoff rules should be informed by the mechanisms that provide straightforward cost-and-benefit understandings, such as economic-oriented mechanisms. It frequently appears that the trade-offs from policy choices occur between a private interest in one service and a public interest in the same service or a competing service (Howe et al., 2014). For instance, energy users could benefit from offshore wind development, while tourists would bear the cost of losing recreation services (Busch et al., 2011). The payoff rules should focus on addressing such gain-and-loss issues by identifying ES values and creating economic incentives to change the individuals' activities in policies in terms of economic-oriented measures (Boisvert et al., 2013; Lockie, 2013). Central to these measures is the general rule of "who uses who pays" or "gain more pay more." Approaches such as resource rents, mooring fees, carbon trading markets, wetland banks, pollution taxes, and other payments for ESs are in line with these general principles (Bruckmeier & Höj Larsen, 2008; Kay et al., 2003).

4.4 Case study: Qingdao Coastal Strategic Planning

To apply the framework, we examined a specific action situation, namely coastal strategic planning for Qingdao, China, from 2008 to 2014. In this specific action situation, the actors in diverse positions have made choices among the available options for managing coastal ESs. These choices were made according to the information these actors could access about the ecosystem conditions and the gains and losses of potential outcomes. The governance structure involves three levels: the Shandong provincial government, the Qingdao municipal government, and the relevant district and county governments (in this chapter also referred to as local governments). Qingdao is located on the southern coast of the Shandong Peninsula in

East China (Figure 4.2). In 2014, Qingdao covered a territorial area of 11,282 km^2 and an ocean area of 12,240 km^2, where the coastal area was 3,488 km^2. Qingdao is one of the largest coastal economic centers in China. Its coastal area covers an extended coast line rapidly developed for international sea ports, large aquaculture areas, industrial parks, residential areas, and tourism. The most important ESs in Qingdao include the provision of seafood and material, transportation, coastal spatial resources, water purification, tourism, and the maintenance of wetland habitats and biodiversity. However, the ecological functions have been threatened by a long history of over-extraction, severe pollution from territorial development, and climate change.

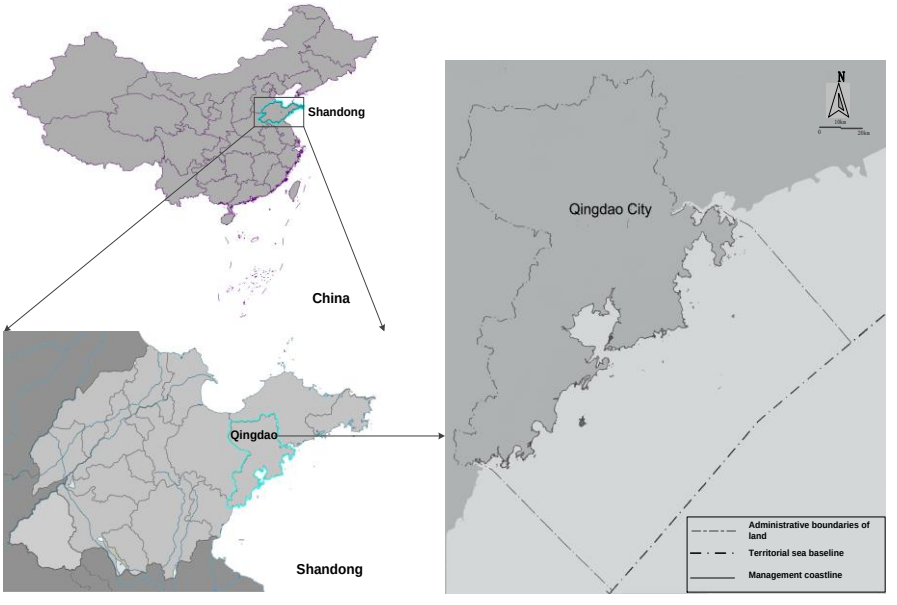

Figure 4.2 Qingdao and the Shandong Province

Recently, Qingdao's coastal governance has implemented innovative approaches (e.g., establishing multiple-use zoning and enforcing ecological compensation), which have been first introduced in several strategic plans (e.g., the Overall Urban Plan of Qingdao for 2011–2020). However, despite all of the efforts, the entire range of ESs was not taken into account (see Chapter 2). The strategic plans are part of a critical action situation, in which the actors' behaviors and ES utilization have been greatly affected and structured through a range of operating constraints, facilitating our insights into the specific rules-in-use.

4.5 Data collection and analysis

For the case study, the primary data included document analyses and 24 semi-structured

interviews with key stakeholders. A number of spatial plans, legislations, regulations, newspapers, and official reports were collected to gain information about the institutional settings of Qingdao's coastal strategic planning. Subsequently, to gain in-depth understanding of the rules-in-use, a mixture of stakeholders was selected, including experts, planners, and officials, from relevant research institutes and different administrative entities (Appendix A.1). All of the interviewees have been involved in the development of coastal strategic plans and had a certain knowledge background on coasts and oceans. The seven types of ES-specific rules-in-use formed the basis of the interview guide, which mainly consisted of open-ended questions. We analyzed the collected documents and the interview transcripts by using content analysis (Krippendorf, 2004). The evaluative framework was adopted as a coding system (see Appendix D.2). With the assistance of Atlas.ti software, we coded and aggregated the documents and transcripts to identify references, including each type of rule, as well as ongoing discussions about these rules.

4.6 An institutional analysis of coastal strategic planning for Qingdao city

After analyzing the data from the case, we summarized the key findings in Table 4.2. We not only listed ES-specific rules-in-use, but we also included ongoing discussions about these rules. In the remainder of this section, we discuss the results for each type of rules-in-use for Qingdao's coastal strategic planning practice.

Position Rules

Qingdao's coastal strategic planning involves governments, scientific groups, and non-governmental stakeholders and allocates diverse responsibilities to each of these groups at different stages. These allocations have implications for the consideration of ESs. Qingdao's municipal government, Shandong's provincial government, and the local governments act as "promoters of planning and implementation," as well as "supporters of social incentives and innovations." On the one hand, the governments quantitatively set planning goals and allow two authoritative agencies, the Environmental Protection Sector and the Marine and Fishery Sector, to be responsible for coastal and marine protection in the entire planning process. However, both of these agencies appear to wield an insignificant amount of influence on the planning practice. As an environmental planning expert from the Shandong Environmental Planning and Design Institute stated, "To facilitate the role of environmental departments in strategic planning, there is a problem, namely how to place them on an equal footing with other departments to communicate. …Tools for environmental departments to coordinate other sectors are limited." On the other hand, the governments act as supporters for the foundations for incentives and innovations of ES governance. For example, to stimulate the market of coastal and marine services and guarantee fairness, the municipal government established the Qingdao International Marine Property Trading Center for users.

Table 4.2 ES-specific rules-in-use in Qingdao's coastal strategic planning practice

Rules	Existing rules and ongoing development in Qingdao for ES management
Position	Governmental authorities act as "promoters of planning and implementation" and "supporters of social incentives and innovations."
	Technical agencies and experts act as consultants, technical supporters, and knowledge accommodators to guarantee the rationality and feasibility of decision making.
	NGOs and citizens are less active actors; due to a lack of capacity, they are often unable to transfer their ES concerns to strategic levels.
Boundary	Selection criteria consider responsibilities based on certain administrative boundaries, professional and on-the-ground knowledge, and the inclusion of intended audiences for marine economic development rather than ecological development.
	Participation is restricted to consultation in the preparation and final formulation stages.
Choice	Ecological functions and social attributes per zone determine use choices; activities that consume natural space or damage ecosystems are strictly controlled.
	Choices for ES access focus on the authorization of permits and the bidding/auction of use rights.
Aggregation	A hierarchical setup for decision making is made for the provincial and municipal governments; only limited authority rests with local governments and interest groups to decide on the supply of ESs.
	Authorities are not allocated at an ecological scale, but they are allocated on the basis of government sectors to collectively accommodate ES use and supply.
Scope	An abstract "land-sea integration" principle is promoted to match the institution with the ecological scales.
	Planning outcomes are influenced by a limited awareness of ES trade-offs and affected users.
Information	Limited and indirect information on ES conditions are accessible, owing to the lacking of a systematic definition and classification of ESs.
	Supply-and-demand information is provided to deal with multi-targets of ES uses, informing decision-making priorities.
	There is little information about how people impact ESs for strategic decision making, particularly concerning indirect impacts and cumulative impacts.
	There is little information on ES values and spatial modeling results in practice, due to a low level of acceptance among policymakers.
Payoff	The distribution of benefits and losses results from the consumption of limited tradable ESs and is based on economic incentives.
	Administrative penalties emphasize the illegal utilization of development rights or irregular authorization of use permits.

The results show that the governments often encounter a shortage of planning expertise when they perform these two roles. Therefore, technical agencies and experts have been asked to work as important consultants and technical supporters to guarantee the rationality and feasibility of decision making. Meanwhile, these scientific groups accommodate ES-related

knowledge into planning from the early preparatory stage to the approval step (e.g., the Protection and Development Plan for Qingdao Marine and Coastal Areas, 2014).

NGOs (e.g., the Qingdao Society for Environmental Sciences and the Qingdao Association of City Planning), interest groups (e.g., environmental industries), and citizens are also involved in Qingdao's coastal strategic planning practice. However, they have barely informed the strategic planners of their ES concerns due to a weaker capacity and position than the major interest groups (e.g., high-income companies). For instance, a representative of the Qingdao Association of City Planning expressed his concerns as follows:

> "Diverse associations in China, including us, are social organizations. Our development processes and social status are quite different from NGOs of developed countries. Due to the small scale, the low quality, and the weak position, the influence of our social organizations on governments is small. The role that we can play [on planning] is very limited."

In China's strategic planning context, citizens' participation is generally perceived to be poor. Although implicit decisions on the supply or conservation of ESs are considerably in the personal interest of citizen – their well-being in general and their livelihood in particular are affected by coastal strategic plans – citizens do not appear to be aware of the actual and potential influence from strategic plans, which results in a lack of incentives to participate. This indicates that more communication and interaction between governments and citizens might be crucial. This is also the case in Qingdao, as an official from the Municipal Development & Reform Commission observed: "Our plan is so big, and citizens mainly care about their individual livelihood rather than macro-level economic goals or to what extent the plan would be developed at strategic level." By contrast, the high-income firms, as significant ES users and economic-benefit producers in the market, are viewed as being very important to the strategic developments. These major interest groups are able to gain more information and have more opportunities to express their demands in the early phase of the planning investigation. In addition, they often perform as evaluators and provide feedback on the drafts of plans. This feedback is often given more attention by the decision makers.

Boundary Rules

The existing boundary rules in Qingdao's coastal strategic planning point to the following selection criteria. The governments and relevant agencies are inclusive according to their responsibilities in certain administrative boundaries regarding coastal protection and development. Professional knowledge and on-the-ground understandings of social and ecological development are each viewed as a main factor in selecting scientific groups in the planning processes. In addition, the existing boundary rules emphasize the participation of intended audiences for developing both traditional and high-tech marine industries. These

audiences could contribute to plans for driving the marine economy (e.g., new energy, biotechnology, equipment manufacture, transportation, and tourism) over a short-term period. Such preference of selection is illustrated in many strategic plans (e.g., the General Plan of Qingdao West Coast New Area, 2014). By contrast, there is less preference for including ecological interests that lie in ecological/environmental industries. As an official from the Provincial Development & Reform Commission stated: "Marine and coastal ecosystem protection is not a critical part of the plans. This topic is included solely for the integrity of strategic planning. … The main goal is taking advantage of competitive marine industries to stimulate economic development."

The existing boundary rules also determine that the responsible authorities and scientific groups are involved throughout the decision-making process. The participation of other relevant agencies and non-governmental stakeholders is restricted to the preparation and final consulting phases (see also *Position Rules*). The stakeholders that could be affected outside of the municipal jurisdiction have also been involved early and entered the planning arena. One typical example is the development of the Dongjiakou Port (with a port capacity of 600 million tons), which would disturb the fishery resources and produce environmental pollution across the municipal borders (Rizhao Government, 2011). Local communities from the nearby counties and their county governments presented the problems at an early stage. Their activities led to meetings for the understanding of conflicts, negotiations, and a modification of the plan (Shandong Environmental Protection Department, 2012). Obviously, to address ES issues, it would be beneficial to consider the involvement of the related stakeholders.

Choice Rules

The choice rules in Qingdao specify users' actions according to limitations per zone. To avoid the negative impacts of activities and improve the multi-utilization of services, Chinese functional zoning schemes generally clarify what activities are allowed, obliged, and prohibited and under what conditions the multi-services (e.g., the provision of fisheries and spatial resource for a port) can be used for each zone. Ecological functions and social attributes per zone determine the choices of ES uses (Douvere, 2008). Particularly regarding Jiaozhou Bay, which is Qingdao's key production area of ESs, activities are strictly controlled to deal with the growing losses of natural space and ecosystem functions. The choices are specified into prohibiting reclamation, protecting key wetlands and natural coastlines, limiting pollution, and restricting engineering constructions along certain coastal areas (Qingdao Urban Planning Bureau, 2015). These choice rules show a general desire to create a space for ES-thinking among the dominant discourse of "pollution control." A typical example is to emphasize wetland connectivity and landscape diversity in zoning. Such consideration could enable Qingdao to modify the effects of social and natural disturbances, depending on the ecosystem

itself. As a result, a stable provision of services can be guaranteed to a certain extent.

Associated with the limitations per zone, choices for ES access have also been developed on the basis of permit authorization and markets of use rights. According to the Regulations of Qingdao Municipality on the Use of Sea Areas (Committee of People's Congress of Qingdao Municipality, 1999), the precondition for ES production per area is to obtain a permit. Sea-use rights can be chosen through bidding and auction in Qingdao (Huangdao Government, 2015). Such economic-oriented choices allow for the creation of scarcity for sand provision and reclamation space; however, intangible and vulnerable ESs are often excluded.

Aggregation Rules

This case also shows a certain degree of a mix between top-down and bottom-up decision making about ESs. In China, it has always been emphasized that for strategic and comprehensive decisions, the national, provincial, and municipal governments reserve the final responsibility. In this case, the Shandong provincial government and Qingdao's municipal government have the major part of the decision-making power of the strategic planning in terms of granting final approval and validity. Nevertheless, despite the hierarchical setup for decision making, some determinative power has been gradually moved towards the local governments; however, little power has moved towards the local interest groups to decide on the supply of ESs. For instance, the district and county governments are allowed to decide the spatial plan for marine nature reserves and special marine protection areas for locally important estuarial wetlands. As a planning expert from the Institute of Marine Geology stated: "When we collect data and conduct field work to plan for protected areas, local governments know their own area quite well. They could suggest and decide which areas should be protected, and which they prefer for economic development."

Rather than allocating authorities at an ecological scale, fragmented authorities for coastal and marine governance are typical for Qingdao. The responsibilities for coastal and marine governance have been allocated among an array of government sectors, such as transportation, forest, agriculture, land, water, and marine and fishery. Consequently, sectoral integration mainly takes place in the final strategic planning as a compromise to coordinate various ES use and supply in the final draft of plans (e.g., the Overall Urban Plan of Qingdao for 2011–2020). At the moment, a management commission based on the basin scale is being established in Qingdao, which holds the promise of causing lower compromising costs and a better consensus (Committee of People's Congress of Qingdao Municipality, 2014).

Scope Rules

In Qingdao, the scope rules specify planning outcomes involving the understanding of ecological scales and ES interactions. Major strategic plans and relevant policy documents

emphasize the critical principle of "attunement, coordination, and land-sea integration" for coastal and marine governance concerning ecological issues. For instance, in the Protection and Development Plan for Qingdao Marine and Coastal Areas (2014, p.38), this principle is explained as follows:

> "Taking the sustainable development of marine ecological environment as a starting point, planning should integrate land and sea based on marine environmental capacity. The social-economic development and ecological protection requirements of the neighboring land should be sufficiently considered for coordinating diverse interests."

Several interviewees criticized the abstract meaning of the principle and the difficulties in interpreting the principle in the planning practice. As an official from the Shandong Oceanic and Fisheries Department said: "It is an abstract principle that is difficult to explain. …The land-sea integration has been promoted for years, but until now, there is little 'real' and good fulfillment concerning environmental protection." For instance, an outcome of this scope rule is the control of land-sourced discharge based on sea water environmental capacity. However, to get rid of the restriction of pollution control on local industrial development, local governments tend to predict less discharge amounts in the early planning stage for environmental management. Consequently, the environmental protection of the land-sea integration is hardly achieved.

Besides, planning outcomes are limited to certain areas and affected users from ES interactions in Qingdao, particularly with regard to coastal reclamation. The documents that we studied (e.g., the Qingdao Municipal Regulations of Jiaozhou Bay Protection, 2015) strongly emphasize setting forbidden geographical domains for reclamation. The scope rules aim to reduce the irreversible damage on aggregated services (e.g., habitat maintenance, biodiversity, and cultural heritage) and the well-being of people, not only at one location but also at far distant locations. Other ES interrelationships that may occur on-site and off-site are also acknowledged and negotiated in the planning practice, such as the trade-offs between marine industrial production and wetland biodiversity maintenance, as well as the conflicts between aquaculture and water purification. There is only a small part of multiple ES uses and their interactions considered in decision making to coordinate users' interests and use patterns. However, as an expert from the Shandong Environmental Planning and Design Institute noted about the outcomes: "The consideration of how to balance these relationships and how to put them into practice was not written explicitly in the planning documents." Therefore, the integration of ES interactions and users' interrelationships into the current scope of Qingdao's coastal strategic planning practice seem to be less distinct.

Information Rules

To facilitate the decision making on the spatial allocation of resources in a more rational way, coastal strategic planning requires an understanding of current natural conditions. In Qingdao, the rules for information about conditions are not designed based on a systematic definition and classification of ESs. Thus, current conditional information only indirectly illustrates some key ecological conditions and processes by focusing on coastline resources, marine geology, rivers, and biodiversity.

Information on the supply and demand of coastal and marine resources is also required to coordinate multiple uses. In addition, the supply-and-demand information could affect the planners' priorities regarding decision making. Thus, urgent problems could be addressed, such as the maintenance of livelihood relying on fisheries. As a planning expert from the First Institute of Oceanography explained:

> "Our main focus [of information collection] is currently on demand, location, and environment. Our per capita coastline is too short, the per capita sea area is too small, and the use intensity is so high. … The coastline in Qingdao has been entirely used. Except for meeting the demand of tourism, industries, and urban development, the rest of the coastal areas have been dominated by aquaculture. …We need food firstly. It concerns critical livelihood."

Furthermore, findings show that there is a lack of information rules concerning how people impact ESs at a strategic level. A number of legislations and regulations (e.g., Shandong Province Marine Environmental Protection Regulations) call for impact information that focuses on environmental quality at the project level. Moreover, either the indirect impacts or cumulative impacts are asked to perform a role mainly in decision making about project constructions. However, budget and time are restricted for the collection of this kind of information. As a result, secondary data have become the main source of information, such as previous local studies and environmental impact assessments on a similar type of project.

The fourth type of information rules regarding ES valuation and spatial illustration is absent in coastal strategic planning due to a low level of acceptance in Qingdao. For instance, research institutes try to provide policymakers with results of ES valuation, ecological capital, and maps for cost-and-benefit analysis for planning. However, such information is not considered as a necessity and a reliable support in practice. The policymakers hesitate to use the data. As an official from the Qingdao Ocean and Fisheries Bureau explained: "The assessed values are too large to accept and apply. … The models are not based on an adequate understanding of the environmental baseline and dynamic changes. … The research thus seems unreliable." As a result, this kind of information is hardly provided for coordination and consensus.

Payoff Rules

Finally, the results demonstrate that the payoff rules for Qingdao's coastal strategic planning emphasize distributing benefits and losses caused by using marketable ESs based on economic incentives. The major payoff rules relevant for sea use and marine environmental pollution adhere to the project level, sticking to the key principle of "who develops who protects, who benefits who compensates" (Committee of People's Congress of Qingdao Municipality, 2014; Office of People's Government of Qingdao City, 2009). The payoff rules refer to a wide range of ESs, such as water purification, wetland maintenance, coastal landscape, and flood prevention (Committee of People's Congress of Qingdao Municipality, 2010). Only a partial consumption of tradable ESs (e.g., fisheries) and ES proxies (e.g., use rights) with direct causalities has been considered in terms of fees to generate compensation effects. Sea-use fees and ecological damage fees are designed to charge for users to influence their choices of targeted service, activity location, and use pattern by distributing costs in a certain way. Such financial resources from these fees are then allocated for ecological restoration and environmental protection, which may collectively create positive effects for the region.

Apart from the economic-oriented rules that create incentives to influence private behaviors, administrative payoff rules are also in place to guarantee protection. Increasingly, penalties for a range of the illegal utilization of development rights or the irregular authorization of use permits are introduced and emphasized in legal terms.

4.7 Conclusion and Reflection

This chapter proposed a systematic framework that reflects coastal and marine governance with regard to the integration of ESs. To achieve this objective, we gained a theoretical understanding of the rules that are part of the IAD framework and reviewed previous studies to see how the framework of rules-in-use could be operationalized when referring to coastal and marine issues. We then applied this framework to Qingdao's coastal strategic planning practice. Taken together, the results from the literature review and the case study revealed at least five socio-spatial and economic aspects, which should be considered for the further understanding and design of ES-specific rules for coastal and marine governance: (1) conceive of stakeholders as ES users, (2) capture the effect of ecological scaling, (3) understand ES interactions and clarify indirect impacts and causalities, (4) account for ES values, and (5) draw on economic choices for use rights to deal with ES issues.

First, it is important to conceive of stakeholders as ES users when designing rules. Both the literature review and the case study revealed the poor situation of "weak" groups. The well-being of these groups strongly relies on the development and maintenance of ESs in many coastal regions like Qingdao. These groups often lack the capacity, power, willingness, and possibilities to maintain their own benefits or to transfer ES concerns to strategic plans.

Accordingly, ES-specific rules should define the role and responsibility of the users in legal terms (position rules) and encourage the participation of the "weak" users (boundary rules) (Nielsen et al., 2004). Also, certain choice and payoff rules should be formulated based on the users following economic principles, thus regulating the users' activities and specifying "who uses who pays." The uptake of ES-user thinking will facilitate the involvement of more short-term and long-term interests of users. In addition, this uptake will also enable a better understanding of the ecological and social complexities and ways to deal with them (Norgaard & Baer, 2005).

Second, the effect of ecological scaling should be given specific attention. Our case study and previous research (e.g., Hanna, 2008; Holt et al., 2011) uncovered the inherent fragmentation of governance in many coastal and marine regions with regard to administrative responsibilities, sectoral legislations, and strategic information. Accordingly, ecological scaling should be captured by ES-specific rules to address the substantial resistance from traditional institutional arrangements against efficient and flexible ES governance. For example, decision making should be based on an ecological scale (authority rules), such as the promising attempt by Qingdao to establish a new basin-scaled authority. The effect of ecological scaling should also be captured when designing choice rules (specifying activities per zone according to natural attributes), information rules (providing reliable knowledge of affected ecological areas), and scope rules (evaluating outcomes at an ecological scale).

Third, in designing ES-specific rules for coastal and marine governance, it is essential to better understand ES interactions and clarify indirect impacts and causalities (Bennett et al., 2009). The Qingdao case showed the difficulties of identifying, clarifying, and operationalizing the complex ES interactions in practice, which is in line with findings from other ES studies (Howe et al., 2014). The majority of the rules in Qingdao still emphasize direct pollution and environmental factors (e.g., water, air, and soil) rather than a systematic view via ESs. Thus, ES-specific rules should enhance local participation, monitoring, research, and a knowledge-sharing platform about ecological dynamics and causalities (information rules). The understanding of ES interactions should also be involved in, for example, controlling conflicting activities and encouraging compatible ES uses (choice rules), finding potentially influenced audiences (boundary rules), and setting geographical domains to limit off-site impacts (scope rules).

Fourth, the rules for coastal and marine governance should account for ES values. Scholars have argued that ES values are promising for sustainable governance (Laurans & Mermet, 2014). In our case, the social perceptions and values attached to ESs (i.e., seafood and natural habitat reserves) could serve as an example. In practice, however, comparing with marketable services, many intangible and vulnerable ESs are often excluded from governance. The

reliability and the acceptance of ES values and related approaches are also problematic in many cases (Freestone et al., 2014; Xu et al., 2003). Therefore, rules are required that emphasize a systematic ES-related database and tools, which should be built on existing information systems (information rules); meanwhile, the data and tools should be communicated across ecological and administrative boundaries (Primmer & Furman, 2012). To make the non-marketable services inclusive, the importance of those services and their spatial distribution should be taken into account when, for instance, designing ecological compensation (payoff rules).

Lastly, the economic choices for use rights, which are stimulated by attaching prices to ESs and their proxies, are also a key aspect for formulating ES-specific rules. Previous research revealed that administrative control and sanctions may cause less efficient use of ESs (Boisvert et al., 2013). It is argued that the institutions that draw on economic choices for use rights could become more flexible and cost effective when dealing with ES issues (Davis & Gartside, 2001; Mansfield, 2006). Therefore, choice and payoff rules should create scarcity for vulnerable services and increase users' incentives to change their choices and their gains and losses (Boisvert et al., 2013; Lockie, 2013). Meanwhile, to make the economic selection function well, it is also necessary to design transparent trading rules and explicit use property as the case of Qingdao showed (choice rules).

To conclude, many international coastal and marine regions are looking for new institutional arrangements with the goal of integrating ESs for sustainable development. In this context, the developed evaluative framework of rules-in-use provides a method to assess and guide the design of existing institutional arrangements. In doing so, of particular importance is the systemic uptake of the above discussed socio-spatial and economic aspects. In this way, our research contributes to the current development of coastal and marine governance and provides information on potential institutional innovations to address coastal and marine dynamics, uncertainties, and complexities.

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